STRATEGIC MANAGEMENT PROCESS AND ENHANCEMENT OF QUALITY IN HIGHER EDUCATION

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Summary

The purpose of this study is to examine the context in which faculties change their strategy and the effect of the change on quality enhancement. The central question is: how can strategic actions improve quality? The process of strategic management in higher education consists of three steps: strategy formation, strategy implementation and strategy evaluation. Recommended tools for successful strategy implementation and evaluation are quality map and balanced scorecard methods. These theoretical approaches are assessed through interviews with managers and quality assurance experts at the University of Zagreb. Results have shown that strategic actions, based on well-defined and communicated strategic goals, can contribute to the enhancement of quality in higher education, but only when there is a strong organizational culture present.

Key words: *strategy, quality management, higher education, Croatia.*

1. INTRODUCTION

Today, universities are facing dramatic changes. Most of European universities have a long tradition and rich history. They have so far been linked to the national context, and have operated without pressures of competition. Today however, universities compete on the international level, and *changes in the structure, culture, and policy can no longer be understood without taking into the developments and changes*

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in the broader-than-national environment (De Wit, 2010). Croatian universities are no exception. They are going through the process of '*Europeanization*'[3] and need to adapt to the requirements of ESG[4].

Universities formulate and adopt their strategies under the influence of such a changing environment. This paper examines how strategic actions are effected, why and how universities change their strategy. Srikanthan and Dalrymple (2004) argued that *there is a crisis of confidence in the ability of colleges and universities to respond appropriately to public needs and concerns*. In this paper we have tried to define how to respond to stakeholders' needs and requirements. We have analysed how universities shape their strategy and objectives in order to achieve better results and stakeholders' satisfaction.

Yokoyama (2010) stated that *there is general argument that the decentralized higher education systems and institutions which apply management found in the private sector can respond to changing social demand and the market niche more rapidly and efficiently than centralized forms,* although her paper has not found any substantial evidence to support such an argument. Croatian universities are under the process of integration and centralisation, but the University of Zagreb is still largely decentralised. This is another obstacle for a broader strategic approach that would involve all constituent units of the University.

The higher education sector has begun to recognise that strategic planning is necessary in order to maintain its own responsiveness to a rapidly changing environment (Streib and Poister, 1990; Smith et al. 1987.; cited in Alashloo et al. 2005, p. 132). Taking into account changes in the environment, new strategic approaches and requirements, the question arises: how can strategic actions improve quality of the university? In relation to that question, this paper analyses the process of strategy implementation and circumstances in which the strategy changes. Theoretical approaches and conclusions are assessed through interviews with Deans, Vice-Deans, Professors and experts for quality assurance in higher education, all working at consistent units of the University of Zagreb.

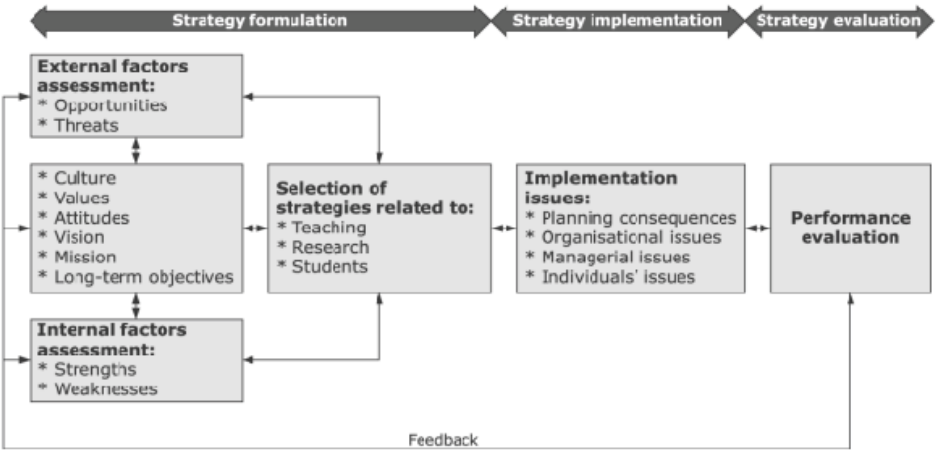
2. THEORETICAL FRAMEWORK

The strategic management process is divided into: strategy formation, strategy implementation and strategy evaluation (see figure 1). Accordingly, the theoretical framework consists of three parts. First, strategy formulation and influence on the quality improvement are defined. Second, strategy implementation and practice in the higher education are analysed. Finally, the third part discusses the enhancement of quality in higher education and its relationship with strategic actions.

[3] De Wit (2010): "*Europeanization* is the European translation of the process of globalization, particularly in the EU but with frontiers that are not fixed."

[4] European Standards and Guidelines for Quality Assurance in the European Higher Education Area

Figure 1: Strategic Management Process in Higher Education



Source: Alashloo, F.R., Castka, P. and Sharp, J.M. (2005) Towards understanding the impeders of strategy implementation in higher education (HE) - A case of HE institutes in Iran, *Quality Assurance in Education*, Vol. 13, No. 2, pp.132-147, p. 133

2.1. Strategy formation

Sminia (2009) analysed the process of strategy formation, through extensive literature research, in relation to the work of Mintzberg, Pettigrew and Van de Ven. He concluded that *future research should include question 'how' with regard to strategy formation towards methods of strategy process diagnosis, as well as assessing the effectiveness of management intervention events.* Thus, we tried to answer the question 'how' and its relation to quality enhancement.

In order to better understand the process of strategy formation, some theoretical approaches and definitions are cited below. Chamberlain (2006:291) defined strategy as *a name for an abstract conception that is constructed or develops naturally within one or more minds.* Another definition is: *the mediating force or 'match' between the organization and environment (Hofer and Schendel, cited in: Ritson 2008:18).*

Distinction should be drawn between strategizing and strategy. Rowe (2008:9) stated: "*strategizing is the thinking about strategy (planning/theorising) and strategic action is the doing of strategy that usually implies some form of implementation and change*". Levels of strategy are: corporate strategy, competitive or business strategy, and operational or functional strategies.

According to Porter (1990, 1996, 1979) there are three competitive strategies (see also Treacy and Wiersema, 1995; Kettunen, 2002, 2003a; cited in Kettunen, 2005:208). These strategies can also be applied to educational institutions: *Differentiation, Cost efficiency and Focus*. The focus strategy can be combined with differentiation and cost leadership. Kettunen (2005) concluded that *the strategy of focus combined with the*

strategy of cost-efficiency is applicable for higher education institutions. These strategies can be adjusted, for example, to profitable growth in continuing education.

Whittingtin (cited in Rowe, 2008:16) outlines four generic schools of thinking in strategic management, while Mintzberg, Ahlstand and Lampel (1998) observe strategy in ten schools. Whittington (2001) stated that *there is dichotomy between schools of thought that view strategy as a deliberate act and those for whom it simply emerges out of every day processes of the organization*. Four generic perspectives on strategy according to Whittington are: *classical strategy* based on ROI (return on investment); *processual approach* which states that strategies are merely managers' simplifications of a complex chaotic world and strategic plans and procedures act only as a comfort blanket, *evolutionary strategists* believe that market forces will ensure profit maximization and survival of the fittest and suggest that it is better to let the environment choose the strategy rather than the manager, and *systemic strategists* accept the idea of transformation and purpose of the organization but believe them to be embedded in the social/political/cultural structures of the organization.

Mintzberg recognises different modes of strategy formulation:

1. *Rational model* – planned, intended and deliberate strategy. Planned and deliberate strategy comes about where there are precise intentions, which are written down and imposed by a central leadership.
2. *Emergent strategy* – according to Mintzberg and Waters, strategies can be deliberate or emergent or a stage in-between. There is a corporate intent followed by its interpretation. Sometimes this intent is not formally written down but emerges over time as part of the culture.
3. *Opportunistic strategy* – an organization may take advantage of changes in the environment or recognise new skills in an opportunistic manner. Alternatively, a firm may be set up by an entrepreneur because of an opportunity in the market place.
4. *Imposed strategy* – strategy may be imposed on the organization. Government policies may have an impact on the strategy. Recession or threat of a takeover may force a strategy of cost cutting and retrenchment.
5. *Realised and unrealised*.

Chamberlain (2006:292) states that *each firm faces unique circumstances in terms of both its external and internal environment, and as such it requires at a minimum, a unique strategy*. It can be applied to universities, in relation to circumstances and environment each university should have a unique strategy. According to Lindblom (cited in Ritson, 2008:24) *strategic choice takes place by comparing possible options against each other and considering which would give the best outcome*. Therefore, universities should take into consideration the context within which they operate and according to that combine the most suitable approach.

Saginova and Belyansky (2008) suggest a strategic marketing approach to develop innovations in the content and delivery of educational services to satisfy a vari-

ety of stakeholders of a university and facilitate positive developments in the society. Bonnema and Van der Waldt (2008) also show that *individual messages and media need to be integrated and co-ordinated in the institutional overall strategy*. Alignment theory (Wong, 2005) emphasizes a strategic fit among the four elements constituting market competitiveness, business strategy, organizational culture and leadership style. Sohail et al. (2006) find that generally the HEI focuses on the cost-cutting strategy especially on cost of sales and operational expenses. In accordance with Combe and Botschen (2004) who argue that *when faced with complexity, an ideological stance to any single strategy paradigm for the management of quality is ineffective* universities need an integrative multi-paradigm approach.

Formulation of a strategy starts with strategic planning. *Strategic planning produces an explicit description of how an organisation is moving from the present day described by the mission in the intended direction and towards the state expressed by the vision* (Fidler, 2002; Davies and Ellison, 2003; Steiss, 2003, cited in Kettunen, 2008:322). Management of the HEI is responsible for defining strategic plans and objectives. While doing that, they must take into consideration international and national educational policies and the regional demand for skilled labour. Furthermore, management must develop internal procedures and structures to realise strategic objectives. Finally, management must be able to measure achievement of strategic objectives. *Strategic management is widely used in HEIs. This involves taking the holistic view of the institution in its environment and aims to map the route to the desired future situation* (Kettunen, 2005, 2006, 2007, 2008).

2.2. Strategy implementation

Implementing a strategy is a change process. So to implement a strategy we need to change our thinking or change our culture or change our structure or some combination of them (Rowe, 2008:13).

According to Ritson (2008:53) strategy implementation includes:

1. resource planning and the logistic of implementation,
2. changes of the organizational structure,
3. improvements of the systems employed to manage the organization.

Strategy implementation in HEI involves the continuation of some ongoing strategies as well as starting some new strategies. Thus, managers should have a clear picture of the situation in HEI. Also, they need tools and techniques to measure the achievements of strategic plans and objectives. *Organizations should continually morph their strategy, conform it to emerging opportunities and incipient trends. In order to do so, people all over the organization should be trained in picking up signals* (De Mast, 2006). Vanttinen and Pyhalto (2009) explored the strategy process and concluded that: "*employers should be taken as active partners in the strategy work from the very beginning of the process and room must be provided for the creation of a meaningful and shared understanding about the strategy and one's own role in it*."

Strategy implementation addresses the issue of *how to put a formulated strategy into effect within the constraints of time, an organisation's financial and human resources, and its capabilities* (Alashloo et al. 2005:134).

Strategic management tools and techniques can be applied to strategic planning within educational institutions. According to Waterman (cited in Trim, 2003:62) organization's effectiveness is determined by the interaction of seven factors: *structure, strategy, systems, style, skills, staff and superordinate goals*. These strategic management tools can help higher education managers to understand better the environment in which the organization competes.

The balanced scorecard approach has been designed as a mechanism to communicate and implement a strategic plan and make it more understandable to employees and other stakeholders (Kettunen, 2005, 2006, 2008). The balanced scorecard provide framework for the implementation of a strategy. It enables managers to translate strategy into measurable and clear objectives. This way it helps higher education management to communicate strategy to the employees and to set precise indicators for measurement of strategy achievement. The balance among external measures for customers, finance measures, internal processes measures and learning measures is needed for successful implementation of a strategy. The development of this tool enables continuous improvement and enhancement.

Another tool to translate strategic statements into objectives and measures is the strategy map. *Strategy maps help the organisations see their strategies and detailed strategic themes in a graphical representation in an integrated and systematic way. They also help the staff to understand why specific targets have been set* (Kettunen, 2008:212).

2.3. Strategy and enhancement of quality in higher education

Education is in constant change: *being influenced by the developments of its external environment, and on the other hand, changes in education actively influences this environment and its needs* (Saginova and Balyansky, 2008:341). What is proving to be important (Power, 2007) is the need for "*intelligent professional leadership" providing a clear vision and strategic direction for educational research, policy and practice in an era of globalisation. By building on the experience of innovatory approaches into tackling then challenges facing educational and social policy and research in an era of globalisation, we can begin to move in more strategic directions and to assume a pro-active stance in a world of constant change.*

Ayoubi and Massoud (2007) showed in their study that 74 per cent of UK universities' mission statements include intents on internationalization. In relation to this result, management in higher educational institutions need to implement effective strategies and take into account characteristics of international environment. Thompson and Green (2005) argued that sustainability should also be an important part of the strategy in HEI.

Although numerous improvements have been achieved, *current performance measurement systems do not reflect the full range of interested stakeholders and are not closely linked to the strategic management of the higher education institutions* (Cullen et al. 2003). Therefore, students should be viewed as customers. But we shouldn't forget other stakeholders of higher education: academic staff, administration, employers, government, society, and professional associations. They all have some needs and expectations related to the quality of universities. Sahney et al. (2008) emphasize the importance of focus not only on external users, i.e. students, but also on internal users of higher education. All these requirements should be included in planning and deciding on a strategy. *A widely accepted view on quality in higher education is the degree to which the stakeholders' needs and expectations are consistently satisfied* (Sims and Sims 1995, White 2000, Zhao, 2003). In a market where stakeholders' needs are recognized, universities need to develop competitive advantage based on the set of unique characteristics. Also, strategies should be communicated to all stakeholders because they influence the formation of brand and corporate perceptions. *The way an organization defines its corporate strategies has a significant impact on how it is perceived by its stakeholders* (Melewar and Akel, 2005).

Once we define the environment in which strategy and quality policy are realized, and after we recognize the stakeholders involved in these processes, we analyze the connection between quality management and strategic activities. Top management is responsible for strategy implementation, and also it is a major driver of quality management implementation (Wilson and Collier, 2000; Kaynak, 2003; Mellat-Parast and Digman, 2007; Lazibat, 2009). Many authors have shown a connection between strategic actions and quality activities. Leonard and McAdam (2004) developed grounded models and showed dynamic interaction among TQM (total quality management), strategy and operations. Huston and Rees (1999:228) stated that *development of quality systems has been seen as one means of developing a competitive edge against other educational establishments*. Davies (2008) argued that linking EFQM Excellence Model self-assessment with strategic planning processes can help higher education institutions to achieve better results. Tetime (2003) showed that it is easier for strategic planning-oriented firms to adopt TQM practices than for non-planning or operational planning firms. Since TQM is very much the same as strategic quality management, *HEIs need to see quality from a strategic perspective* (Osseo-Asare Jr and Longbottom, 2002).

The approach, based on the work of Kettunen (2005, 2008), uses quality maps to sort quality objectives and enhances the role of strategic planning so that the plan is consistent with the international and national environment. This is a stakeholders' approach that is related to the concept of 'fitness for purpose' that sees quality as fulfilling the requirements. The quality management system can be described using a quality map. *This map is a visual representation of how the environment is taken into account in strategic planning* (Kettunen, 2005, 2008). It provides insight into strategic planning, management process and internal processes. This way every employee or other interested party can find their process and connect it

with other processes of higher educational institution. Finally, all those processes should be documented. The documentation includes strategic plans, quality policy based on HEI strategy, management process and internal processes derived from strategy and quality policy. Furthermore, operational plans and course implementation plans are important documents for HEI, because they provide evidence of continuous improvement.

3. DATA AND METHOD

Different theoretical approaches and research results have been studied in this paper. However, most of them do not answer the question 'how' strategic actions influence quality system results. Four case studies of constituent units of the University of Zagreb and five interviews with experts for quality assurance in higher education were carried out. The results of case studies can't be generalised to a population, but they are illustrative and help us understand better the process of strategy implementation. The case studies were carried out in the period from February to May 2010. Each study consisted of interviews and document analyses.

The University of Zagreb is the oldest and biggest university in South-Eastern Europe. It consists of 29 faculties, 3 art academies and the Centre for Croatian Studies, and provides education in a wide range of fields: Arts, Biomedicine, Biotechnology, Engineering, Humanities, Natural and Social Sciences for over 50,000 students.

Leading strategic objective of the University of Zagreb is:[5]

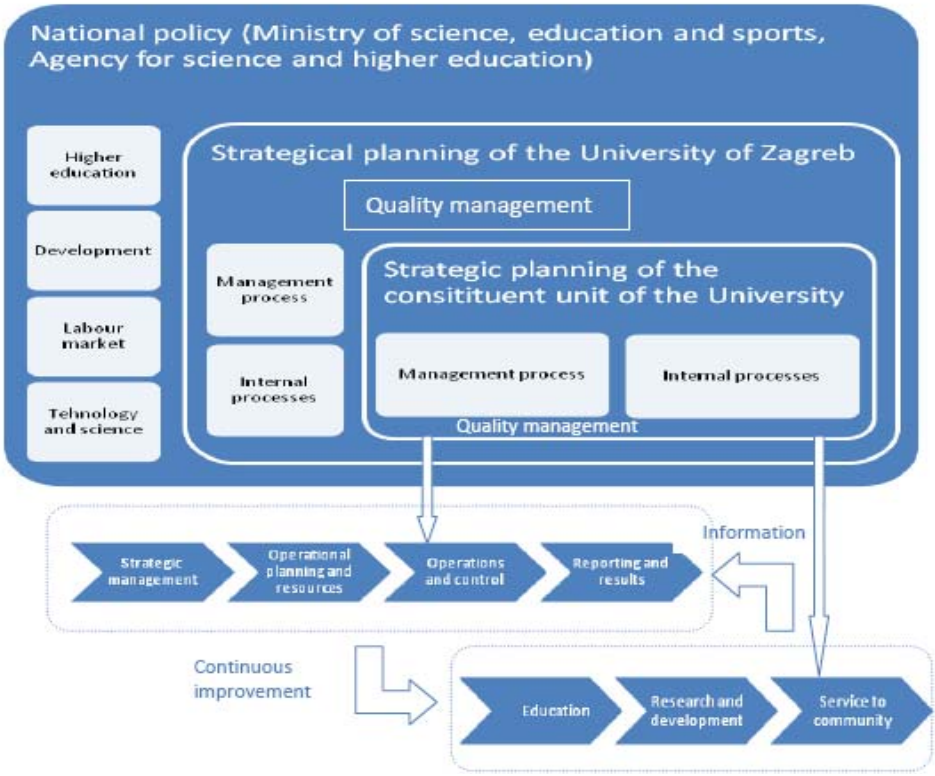
- *integration of the University and linking its constituent units*,
- *increasing research and teaching quality, by participation in significant research projects, and on the international level by intensive participation in international research projects.*

The management of the University wants to integrate the University in accordance with the recommendations of the Ministry and the Agency[6], but it is still characterised by a decentralised management structure. Furthermore, strategic plans and objectives include expressions such as inter-disciplinarily, internationalization, research development, quality, but actual implementation depends on the efforts of the constituent units and their own strategic plans and objectives.

[5] University of Zagreb, ISKORAK 2001 and Research Strategy 2008-2013

[6] Ministry of Science, Education and Sports and Agency for Science and Higher Education are leading institutions and creators of National policy of higher education in Croatia

Figure 2: Quality map of the University of Zagreb



According to Kettunen's work (2005, 2008) and based on the results of case studies, a quality map of the University of Zagreb was created (see figure 3). We can see that strategic planning and quality management of the University is affected by decisions and requirements of National policy. On the second hand, it is influenced by other environmental factors, such as: labour market, development of the country, technology and science etc. Sometimes, it is *difficult to see how the government policy itself, of imposed teaching quality assessment, actually complies with the basis quality benchmark of "fitness for purpose*" (Milliken and Colohan, 2004). Therefore, the question reveals: how to formulate unique strategy, considering unique circumstances, when there are institutional constrains? What if some requirements of our stakeholders are different or even conflicting with the national policy? This is particularly evident when we know that a service quality perspective is slowly beginning to be accepted in higher education, and when student is more seen as an active participant in the learning process than as a product or customer (Wiklund et al., 2003; Lazibat, 2005). This is even more evident when we look at the level of constituent units. When they formulate strategy and quality policy they must respect requirements of National policy, Strategic plans and policy of the University and their environment.

Kettunen (2005) argues that *cost efficiency is a natural choice for strategy in the public sector, where financial resources are limited. The primary management and measurement should emphasise cost reduction and efficiency. Typically taxpayers provide the financial resources for educational institutions, which have limited annual budgets for their degree programmes.* The situation is similar at the University of Zagreb. It is financed in accordance with the principle of *lump sum* [7]. There are great differences in the financing structure of the individual constituent unit. Some of them make a high profit on projects, lifelong learning and similar programs, while others have a very small share of their own profit in total amount. This diversity is another issue related to the strategy and policy formulation.

After we analysed the situation and issues at the University and constituent units, we present the results of the study on possibilities for enhancing quality through the process of strategy formation and implementation.

4. RESULTS AND DISCUSSION

Among four faculties analysed in this study, one has introduced a quality management system according to ISO 9001:2008 in the entire organization, and one only in the administration. Furthermore, all faculties meet basic quality requirements of the ESG standards and guidelines in accordance with the recommendation of the Agency for Science and Higher Education and the Act on quality assurance in science and higher education. Reasons for the implementation of ISO 9001 were: operational improvements, arranging certain segments of the Faculty, defining responsibilities of employees to perform tasks more effectively, develop distinctive management system in order to improve competitiveness.

Problems that occurred during implementation and maintenance of the system are:

1. *Employee resistance* - resistance to change; belief that the new quality system is not appropriate for the Faculty, increased scope of work.
2. *Increased documentation* - more time and effort invested to update the documents, the problems arose because all the employees are not involved on time in the adjustment of documents related to their responsibilities.
3. *Internal communication* - requirements and changes caused by implementation of quality management systems are not successfully communicated to all levels of employees, some employees are not familiar with their role in the system.

Horizontal analysis of the case studies revealed common issues and obstacles to the development of effective realisation of strategic plans and quality objectives.

[7] Croatian Universities are financed by the *lump sum* principle. They receive an annual amount of funds that is then allocated to its constituent units, according to established criteria.

All Faculties have a documented strategy, coherent with the strategy of the university and the National Policy. The strategies contain information about quality system implementation and the need for further improvement of quality. Students and teachers were involved in the development of the strategy through their representatives at regular meetings of the Faculty Council.

The input for the strategy includes:

- Information on the previous work of the Faculty,
- Analysis of the resources of the Faculty,
- Environmental requirements, primarily requirements of the Ministry, Agency and University,
- International cooperation and internationalization,
- Research projects and other projects,
- Information on student satisfaction and needs,
- Information on employee satisfaction and needs.

The conclusion is that the process of strategic planning and formation was successful and included all relevant information.

When we consider the implementation of the strategy and its communication to employees, the results are pretty bad. Mostly, employees are not familiar with the strategic plan and goals. Therefore, improvement of the communication could lead to better final results. Also, monitoring of strategy results has not been solved. Measurement results are associated with annual or periodic reporting and some information about strategy results is available, but it is not systematically solved. However, some of the interviewed parties expressed interest for better understanding of the tools for measuring outcomes and communication of the strategy, which can be considered as an additional contribution to this paper.

When asked how the process of formation and monitoring the strategy affects the quality management system, respondents answered positively, but without a clear argument. It is a common opinion that when all employees are familiar with the plans, strategies and quality objectives, improvements related to employee motivation and increased level of quality culture occur. Furthermore, in the situation when they expect the integration of university, most faculties are not motivated to invest great efforts in improving strategic activities.

These results suggest that analysed constituent units of the University have not developed an organizational culture. The success of all activities related to strategic improvement and quality system improvement depends on good organizational culture.

If it fails, all management efforts are ineffective. Therefore, management of the constituent units should focus on building organizational culture, education and communication among all stakeholders.

5. CONCLUSION

Today, universities are influenced by a changing environment. Thus, higher education institutions have recognised the need for strategic planning in order to respond to a new environment. The formulation of a strategy in higher education should take into consideration unique circumstances of every institution, and constraints and requirements of the environment. However, effective planning is not sufficient. Higher education institutions need to communicate their strategy to all stakeholders and build a system for monitoring results. Quality map and Balanced Scorecard are recommended tools for effective strategy and policy implementation.

Many authors have shown a connection between strategic activities and quality improvement. Most of them argued that it is easier to achieve better results if quality management and strategic planning are connected. Theoretical assumptions have been assessed through case studies at the four constituent units of the University of Zagreb. The results of the case studies can't be generalized, but it is illustrative and helps us to better understand the strategic management process. The constituent units of the University are affected by the start of the integration process and changes related to it. The process of strategy planning has been rated successful. Problems arise during strategy implementation. Strategic plans and objectives are not well communicated to employees and other stakeholders. There is no system in place for measuring outcomes of strategic plans. All these problems arise due to underdeveloped organizational culture. Formal procedures and management efforts are ineffective when organizational culture is weak. Thus, attention should be given to building organizational culture and communication among all stakeholders.

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PROCES STRATEŠKOG UPRAVLJANJA I UNAPRJEĐENJE KVALITETE U VISOKOM OBRAZOVANJU

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Sažetak

Svrha ovog rada je analizirati kontekst u kojem fakulteti mijenjaju svoje strategije i učinak tih promjena na kvalitetu. Temeljno pitanje je: kako strateške aktivnosti mogu unaprijediti kvalitetu? Proces strateškog upravljanja u visokom obrazovanju sastoji se od tri koraka: oblikovanje strategije, implementacija strategije, vrednovanje rezultata strategije. Preporučeni alati za uspješnu implementaciju strategije i vrednovanje rezultata su mapa kvalitete i balanced scorecard metoda. Ovi teoretski pristupi su analizirani putem intervjua s upravom fakulteta i stručnjacima za osiguranje kvalitete sa Sveučilišta u Zagrebu. Rezultati pokazuju da strateške aktivnosti, utemeljene na jasno definiranim i prenesenim strateškim ciljevima, mogu doprinijeti unaprjeđenju kvalitete u visokom obrazovanju, ali samo onda kada postoji jaka organizacijska kultura.

Ključne riječi: *strategija, upravljanje kvalitetom, visoko obrazovanje, Hrvatska*

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IMPROVING THE QUALITY OF INLAND CREW, SHIPS AND INLAND WATERWAYS

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Summary

Quality level of inland waterway crew and inland waterways is closely related to traffic safety on these waterways. High quality inland crew, ships and inland waterways are important factors of safety and of minimizing losses. Damage to water transport occurs as a result of collisions, spills of oily water and low levels of protection at work. According to the statistics of the American Waterway Organization (AWO), most damage during voyage on inland waterways is caused by human error. The author analyzes the occurrence of accidents on inland waterways and their possible causes. In order to reduce the damage and the number of accidents, measures have been proposed in order to reduce the possibility of occurrence of human error by implementing safety management systems and increasing the quality of crews.

***Key words**: inland waterways, loss, safety, quality, crew.*

1. INTRODUCTION

Inland waterways are all navigable waterways on rivers, lakes and canals which are arranged, marked and opened for safe navigation [5].

An increased level of safety of navigation in inland waterways worldwide is achieved among other things through both international agreements and conven-

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tions. The result of such agreements worldwide is the improvement of existing infrastructure and superstructure, development of new waterways, introduction of new regulations on safety of navigation and environmental protection, implementation of existing regulations, standards and customs, survey etc.

Inland waterway traffic records an ever increasing traffic density. Consequently, new channels are being built and new solutions are being found in order to enlarge inland waterways, etc. The development plan of inland waterways in Europe has been summarized in the Programme for inland waterways (*Navigation and Inland Waterway Action and Development in Europe - NAIADES*) [4].

The technology of water traffic is considered not to be developing in a satisfactory manner, when compared to the increase in traffic. The advantage of water traffic in relation to other branches of transport becomes apparent when observing the following facts:

- Transport cost are relatively low
- Pollution is relatively low, and
- Navigation is safe.

The interests of inland waterway crew are not appropriately valued. Working hours and tasks related to various professions are determined by the rules and regulations and agreements of *the International Labour Organization (ILO)* signed by *the International Transport Workers' Federation (ITF).*

An international agreement on the education of inland waterway crew does not exist. In most cases it depends on national legislation. In this sense, such regulations refer to the rules and regulations laid down in the STCW Convention. However, according to the statistics of the American Waterway Organization (AWO) [9], most damage during voyage on inland waterways is caused by human error.

2. DANGERS AND DAMAGES IN NAVIGATION ON INLAND WATERWAYS

The quality of inland waterway crew and waterways is closely connected to traffic safety on those waterways. The quality coefficient of crew, vessel and waterways (KV) can be expressed as a factor defined by the ratio of the number of damage occurrences (N_{st}) and the ship's and navigation safety (S_{bp}) (1):

$$KV = \frac{S_{bp}}{N_{st}} \quad (1).$$

Dangers are accidents which can cause the loss of human life and partial or total loss of objects. The level of danger is evaluated on the basis of damage statistics in individual areas.

Damages are usually expressed as loss of human lives, number of injuries, quantity or value of damaged or lost cargo or vessel or similar objects [19].

Ship's safety in navigation can be expressed as a function (2):

$$S_{bp} = f\left(b, pp, \rho_p, ost\right) \quad (2),$$

Where:

b - ship and cargo safety,

pp - waterways safety,

ρ_p- traffic density,

ost – other factors.

According to function (2) it is obvious that the quality of inland navigation is considered good if the following hypotheses are satisfied:

- Waterways through which the vessel navigates have a satisfactory level of safety;
- Both the ship and crew have a satisfactory level of safety;
- Cargos are considered not dangerous for transport;
- Other factors are considered favourable.

The safety of waterways is considered satisfactory if they are regularly maintained, if they possess accurate necessary signs, if they possess the means to facilitate navigation such as, for example, River Information System - RIS, Vessel Tracing System - VTS, Electronic Charts Display Information System - ECDIS, Automatic Information System – AIS etc. Apart from the abovementioned factors, the accident statistics done for waterways with satisfactory level of safety and observed through a longer time period should provide data on accidents that occur rarely.

The level of vessel and crew safety is considered satisfactory if all international safety regulations concerning construction, maintenance, classification, equipment, crew, quality systems and others are met. Safety regulations are prescribed in legislation and by international organizations and are ratified by member countries. They are prescribed by conventions of which the most important are: *Safety of Life at Sea* - SOLAS, *Standards of Training, Certification and Watch keeping* - STCW and others [9]. They may be supplemented by special requirements of a ship's register, internal shipowner's regulation books and others.

Cargo danger is measured by the extent of damage to crew's health, cargo, vessel and environment.

Other factors include unexpected and rare causes created by force majeure which can jeopardise people, ships and cargo. These are, for example, difficult navigation weather conditions, unexpected dangers on the waterways and similar.

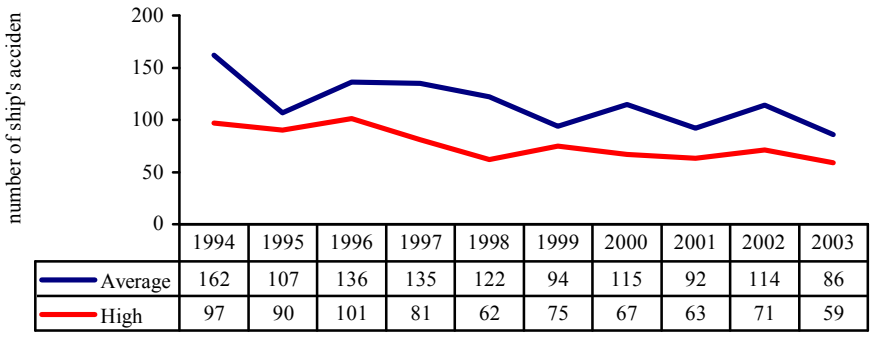
Loss of life and injuries (table 1), as well as damage to vessels and to cargo (graph 1), have tended to decrease over the past several years.

Table 1: Statistics of accidents on inland waterways in USA in 2007

USA inland waterways	Deaths		Work injuries	Lost time due to injuries	Over-boards
	Working hours	Number			
	69,079,233.83	3	858	443	66

Source: AWO Report 4th quarter 2007, available on: *www.americanwaterways.com*

Graph 1: Statistical overview of injuries and damages in the USA between 1994 and 2003 on inland waterways



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Average	162	107	136	135	122	94	115	92	114	86
High	97	90	101	81	62	75	67	63	71	59

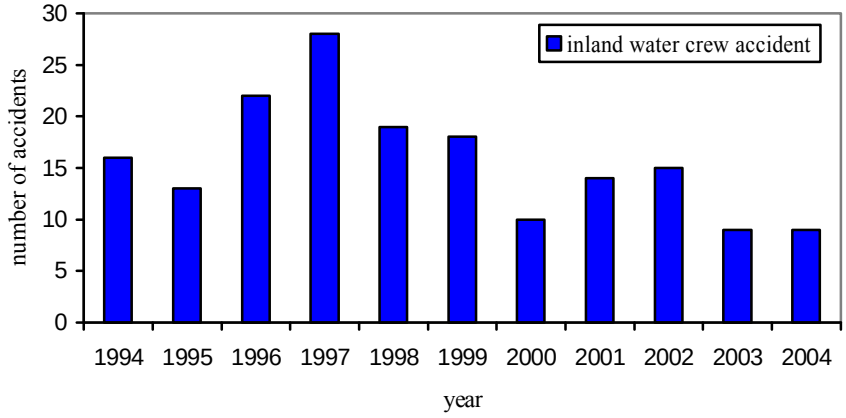
Note: Average damages are considered those in the range between USD 50,000 – 250,000, without human injuries and with a low level of pollution (0.04-4 t)

High damages are considered those in the range from USD 250,001 and higher, with at least one human injury (wounding, death), and where the level of pollution surpasses 4 tons.

Source: US Coast Guard, US Army Corp of Engineer

Judging from the statistics, a decrease is evident in the number of shipowners' accidents on inland waterways (graph 2). It is important to aim at keeping accidents to a minimum and raising the safety level.

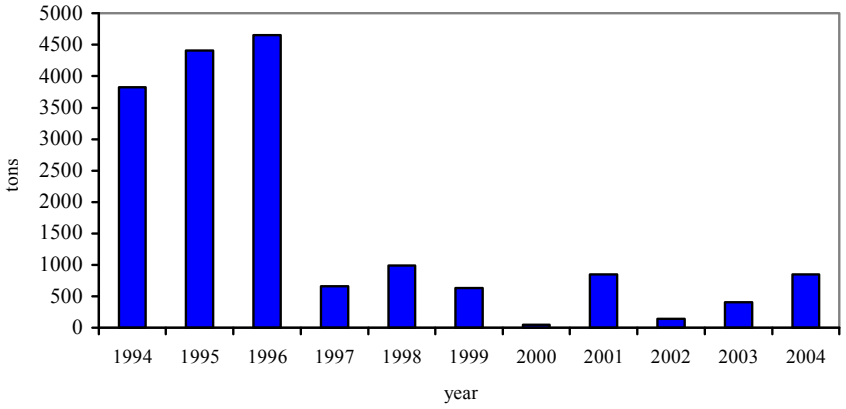
Graph 2: Number of inland water crew accidents on inland waterways



Source: US Coast Guard -AWO Safety Partnership

Insurance companies do not pay for damage claims for shipowners' accidents [14], but damage to cargos, to a vessel's hull and the environment can be extensive. Therefore we endeavour to reduce these types of accidents (graph 3).

Graph 3: Quantity of fuel and fuel products released by barges between 1994 and 2004, expressed in tons



Source: US Coast Guard and US Army Corp of Engineer

According to the AWO, a considerable increase is expected in traffic on inland waterways. Waterways could represent a great danger in the case of a terrorist threat, largely due to their vulnerability and their paths passing through large cities [3].

3. PROPOSALS FOR IMPROVING THE LEVEL OF SAFETY MANAGEMENT IN WATER TRAFFIC

In order to reduce possible accidents caused by human factor on vessels in the maritime commercial fleet, the International Safety Management – ISM code has been introduced [10].

The aims of the ISM code are:

- Developing safety measures
- Reducing injuries and human casualties
- Reducing environmental pollution
- Reducing property damage [2].

For now, the ISM is used as obligatory by the SOLAS convention for maritime ships on international journeys. A state can announce the obligatory use of the ISM in its national waters. The ISM is considered partially harmonised with the standardisation requirements for achieving the 9002 standard [20].

The application of the ISM reduces the chance of possible human error. Human error most commonly occurs as the result of oversight, tiredness, forgetfulness, negligence, handling errors, clumsiness, insufficient knowledge of equipment, misuse of equipment, non-use of occupational safety equipment, abuse of alcohol and drugs, lack of information on operations etc. [2].

The ISM regulation book prescribes the rules of behaviour for many situations on board. Apart from the abovementioned, its obligatory requirement is the use of a check-list. It is considered important to help prevent oversight as well as incorrect procedures in critical situations. It prohibits the abuse of alcohol, narcotics and similar substances on-board. It requires obligatory documentation of data related to the crew, activities on board, safety equipment and other. It gives an insight on the company's and ship's hierarchy, responsible persons, crew duties, communications, archives, ship's documentation and other.

Full application has been suggested of an adapted ISM code to ships on inland navigation under the name ISMIW *(International Safety Management Code Inland Waterways)* according to the algorithm from image 1, ISMIW would have the same purpose, but different safety procedures due to the difference in the type of transport through sea routes and inland waterways. Just like the ISM regulation book for sea traffic, it would be used for all ships on international journeys. Table 2 presents the effects of introducing the ISM code for sea traffic. An analysis was carried out for the Greek commercial fleet which is considered to be one of the biggest in the world.

Table 2: Review of accidents prior to and following application in sea navigation

Time of accident	Vessel type	Reason for accident	
		Human (%)	Other (%)
Prior to ISM	Others	49.3	50.7
	Tankers and RO-Pax ships	84.0	16.0
Following ISM	Others	48.7	51.3
	Tankers and RO-Pax ships	54.8	45.2

Source: Tzannatos, E., Kokotos, D., *Analysis of accidents in Greek shipping during the pre- and post-ISM period*, ScienceDirect, Marine Policy, Journal homepage: www.elsevier.com/locate/marpol

Application of the ISM code succeeded in reducing the number of accidents caused by human error. Similar results are expected as regards traffic on inland waterways because of the affinity of these two traffic branches.

Due to the increase in occupational safety, an annex to the ISM code was introduced: *The Safety Management System - SMS*. Adaptation of the SMS regulations for transport on inland waterways into the *Safety Management System for Inland Waterways – SMSIW* is being proposed. SMSIW would contain:

- A safety and environmental protection policy
- Instructions and procedures for occupational safety and environmental protection in accordance with the laws of the state in which the vessel is located
- A definition of the method of vessel to shore communication
- A definition of the level of authority on-board, method of communication and hierarchy
- Procedures for reporting an accident
- Procedures for preparing for and reacting to an alarm signal.

Increasing the level of quality would result in better operation as a result of greater utilisation of human and material resources. It would be based on the clarity of communication between inland crew concerning the issue of understanding work duties, decision-making etc. Effective organisation of man power is considered to be an important factor with regard to tasks in order to achieve as good a final result as possible. This kind of management has already been used for several years in sea traffic, known as *Bridge Team Management – BTM*, namely the *Bridge Resource Management - BRM*. It should certainly be applied to management and transport on inland waterways. BTM ensures improved team work, communication, hierarchical structure and decision-making, resulting in an improvement in safe navigation. STCW 95, chapter B VIII/2 is recommended.

It is being applied in procedures such as:

- Voyage planning
- Crew work planning
- Emergency procedures
- Bridge Standing Orders
- Taking-over the duties of the captain/pilot.

An international agreement on the minimum norms of education for inland waterways crew is being considered. This kind of agreement for sea transport has been provided for by the STCW convention. The agreement would mean an improvement in the quality of education and training of inland crew. On the other hand, it would contribute to a better understanding of the importance of safety as well as vessel protection on inland waterways. An increase in the level of education for ship officers, captains and ship managers of inland waterway ships transporting dangerous cargo and passengers is being proposed. The proposal would include a passenger transport limit of 100 people.[4]

4. MEASURES FOR EVALUATING THE WORK OF INLAND CREW

As a consequence of the increase in the responsibility for navigation of the inland crew, the introduction of new proposals and increased demands in terms of education and training, measures are being proposed which would describe each rank on inland waterway ships. These kinds of measures would be used to establish rates on inland waterways. The necessity of these kinds of measures arises from a possible increase in the number of inland waterways crews with the arrival of cheap labour from the Far East. It would lead to a reduction in crew costs and a decrease in their quality. Therefore, the application of coefficients that would determine a crew's quality is being proposed:

- Complexity of profession
- Responsibility of profession
- Effort of profession
- Price of object connected to the profession
- Risk of profession.

[4] The number of 100 passengers has been taken as the limit for authorisation for a river raft skipper. Pursuant to the *Regulation on professions and conditions for acquiring the ranks of crew member of commercial ships for inland navigation of the Republic of Croatia*, authorisation for a river raft skipper (Article 31), provides for the handling of a non-propelled river rafts up to a bearing capacity of 50 t or a capacity of 100 passengers.

The complexity of profession F_s can be expressed by the function (3) assisted by the coefficients:

- Responsibility of profession F_o
- Effort of profession F_n
- Price of object F_c
- Risk of profession F_d.

$$F_s = f\left(F_o, F_n, F_c, F_d\right) \tag{3}.$$

The responsibility of profession is the function of the total number of people n for which the rank of a determined profession is responsible:

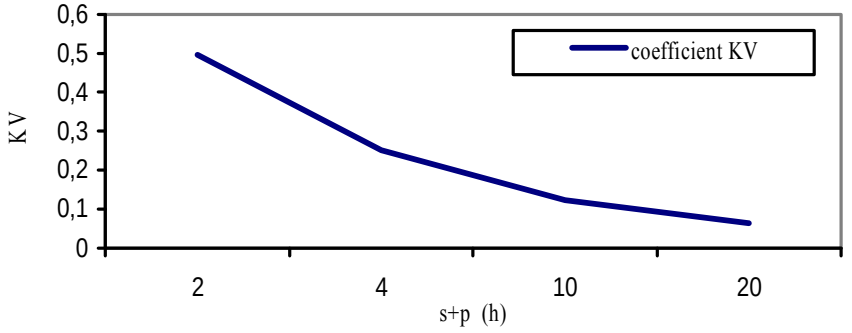
$$F_o = f\left(n\right) \tag{4}.$$

Effort of profession is the function of working hours s and hours of preparedness p which constitute the working hours estimated for position under consideration:

$$F_n = f\left(s + p\right) \tag{5}.$$

The ratio between the coefficients (KV) and the number of working hours onboard is hypothetically shown in graph 4.

Graph 4: Graphical overview of the KV coefficient depending on the sum of working hours and hours of preparedness



The coefficient of the price of the object related to the profession is the function of value of the object which is being managed:

$$F_c = f(C) \tag{6}$$

The risk coefficient F_d is the function of the probability of injury or loss of life which describe each rank, that is, the working environment. The D value is obtained based on the statistical data of the sum of injuries in the work place for each rank:

$$F_d = f(D) \tag{7}$$

Each rank can be described on market basis by the coefficient of availability $K_{A..}$ The coefficient of availability is the proportion of actual supply n_o and demand n_n on the labour market.

$$K_A = \frac{n_o}{n_n} \tag{10}$$

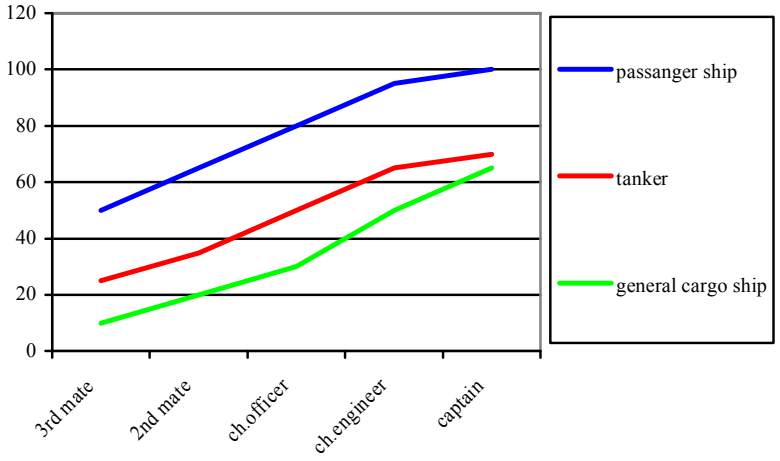
The value of the inland waterways crew work V_b can be expressed in the following way:

$$V_b = \frac{f(F_s)}{f(K_A)} \tag{11}$$

The application of factors of complexity and the coefficient of availability as parameters for determining the quality of inland crew, that is, determining the personal income, is proposed.

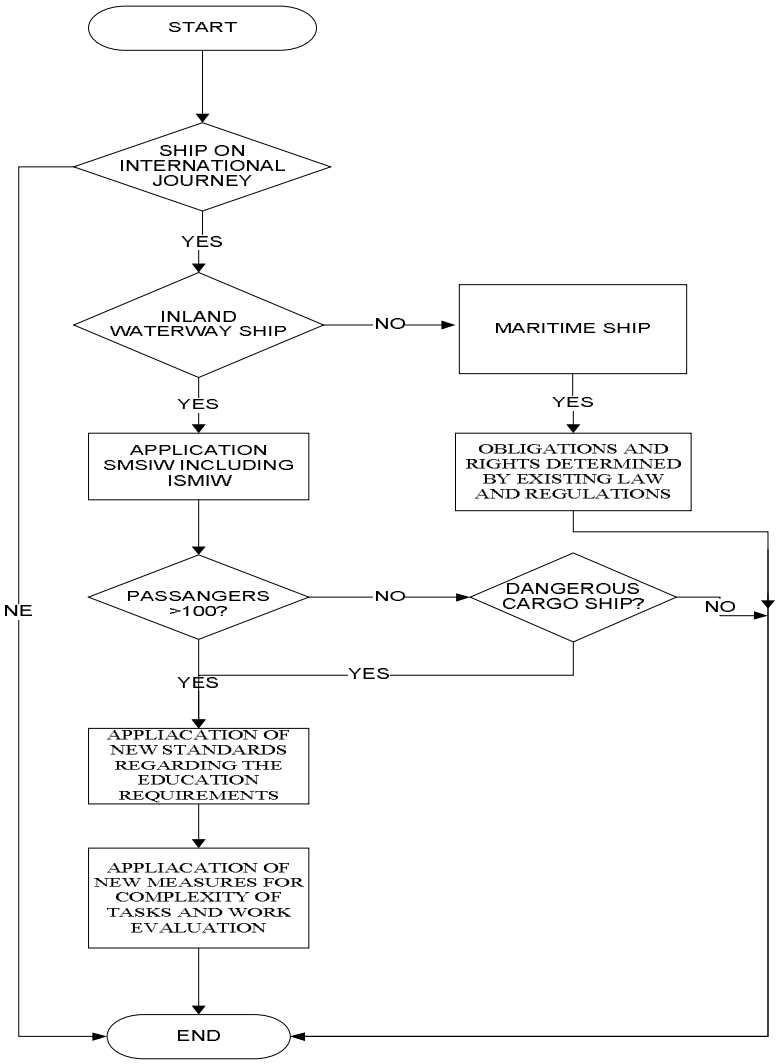
By elaborating on the measures for each type of vessel and professions on vessels, some hypothetical data can be obtained (graph 5).

Graph 5: Hypothetical example of evaluation of a crew according to their profession and type of vessel



The application of new measures for evaluating work is proposed, as well as the application of SMSIW and ISMIW according to the algorithms shown in image 1.

Image 1: Application of new measures for a quality system on inland waterways



5. CONCLUSION

Traffic through inland waterways is considered the most cost-effective method of transport. The level of inland crew and waterways quality is closely connected to the traffic safety on those waterways. It is not considered satisfactory. The reason for

that is evident in the example of corridors of the most important waterways which often traverse industrial centres, cities etc. Frequent worldwide terrorist threats make this way of transport vulnerable.

In order to raise the quality of vessels and crews, this paper proposes the introduction of the ISMIW code, the SMSIW code and both BTM and BRM regulation books which are already being applied in sea transport. Their application should be introduced as the condition for obtaining the ISO standards for vessels and companies that operate on inland waterways.

The introduction of new standards of education in the world is considered necessary due to the influx of cheap labour from the east with suspect training skills and levels of education. The proposed prescribed standards would be applied to inland crew officers transporting more than 100 passengers and dangerous cargo.

Due to the noticeable disproportion in incomes of the members of inland crews, the application is proposed of measures which would determine the minimum personal incomes of inland crew members giving due regard to their quality. It would depend on the rank of the member of an inland crew, level of education and training, type of vessel, overtime, and the ship's value. Personal income coefficients would vary according to the coefficients of demand and supply on the market. Personal incomes would entice inland crews and operators to adhere to safety measures, working hours, and it would also increase the level of education and training.

The paper suggests supplementing and applying the abovementioned measures to a quality system for inland waterways.

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PODIZANJE RAZINE KVALITETE BRODARACA, BRODOVA I UNUTARNJIH PLOVNIH PUTOVA

***Pero Vidan*[5], *Josip Kasum*[6] & *Frane Mitrović*[7]**

Sažetak

Razina kvalitete posade i unutarnjih plovnih putova je usko povezana sa sigurnosti prometa na njima. Kvaliteta posade, broda i unutarnjih plovnih putova bitan je čimbenik sigurnosti plovidbe i sprječavanja nastajanja šteta. Štete u vodnom prometu nastaju kao posljedica sudara, izlijevanja zauljenih voda i slabe razine zaštite na radu. Prema statistikama Američke organizacije za unutarnje plovne putove (American Waterway Organisation-AWO), uzrok većine šteta nastalih u plovidbi unutarnjim plovnim putovima je ljudska nepažnja. U ovom radu autori analiziraju pojavu nezgoda na unutarnjim plovnim putovima i njihove moguće uzroke. S ciljem smanjivanja šteta i broja nezgoda, predlažu se mjere smanjivanja mogućnosti pojave ljudske pogreške uvođenjem sustava upravljanja sigurnošću prilagođenog unutarnjoj plovidbi te podizanju kvalitete brodaraca.

Ključne riječi: *unutarnji plovni putovi, nezgode, sigurnost, kvaliteta, posada.*

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